

## Image Registration Is Required for Experiments of Accommodation

Experiments require baseline references from which to measure change. When comparing images, multiple fixed, positional reference points must be identified, and then the images must be registered with regard to these positional references before assessment of change. These basic methodological requirements are lacking in studies by Croft et al.<sup>1,2</sup> in both the human and monkey accommodation comparisons.

The authors state: “During ultrasound biomicroscopy (UBM) ... there was minimal convergent eye movement, if any.... Thus, there was very little, if any change in angle of the transducer to the eye during accommodation.” This generalization is not a quantitative measure of the inherent stability or variability of their experimental system. Repeat UBM measurements are required without any other perturbation of the system. First, the UBM transducer itself should be moved and then, with the position of the UBM fixed, just the eye should be moved in different directions and speeds.

The failure of the authors’ experiments is exemplified in Figure 1. The corneal lengths in the unaccommodated

and accommodated images of the eyes are different. The difference in corneal lengths reflects a change in alignment between the eye and the UBM transducer. Either the eye or the transducer moved or both relative to one another so that the plane (or axis) of the image was changed.

The authors need to ensure that images are properly registered before making their comparisons.<sup>3,4</sup> Their invalid data obfuscate the ability to understand the actual mechanism of accommodation and presbyopia.<sup>5</sup>

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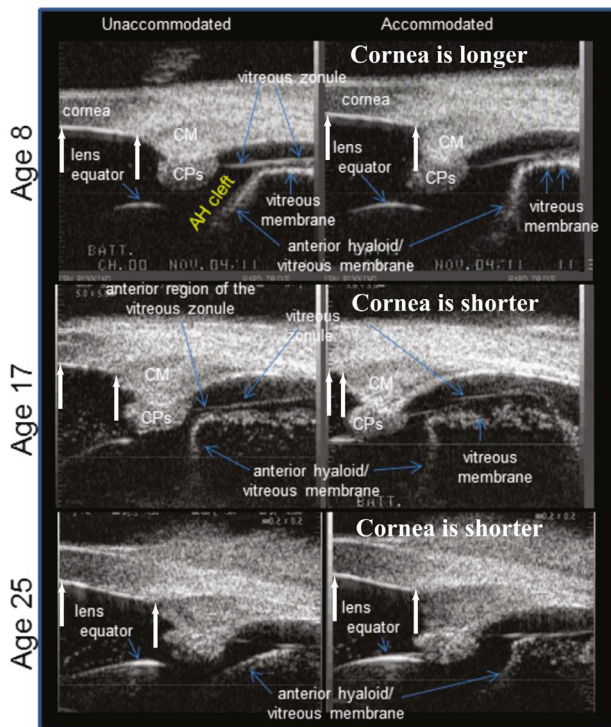


FIGURE 1. Reproduction of the left-sided UBM images of Fig. 2 from Croft et al.<sup>2</sup> with arrows and labels added for clarification. Note: the corneal lengths are different, indicating the imaging plane (axis) changed between the unaccommodated and accommodated images.